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U.S. DEPARTMENT OF AGRICULTURE • Economic Research Service

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AGRICULTURAL ECONOMICS RESEARCH VOL. 25, NO. 4, OCTOBER 1973

Alternative Analyses of Farm Growth*

By Roger P. Strickland, Jr.

Four strategies for farm growth are analyzed and compared on the basis of ownership, equity, and productive capacity achieved, and on the basis of resistance to adversity. The primary tool of analysis was a model utilizing a stochastic simulator interfaced with both ex ante and ex post linear programming routines. The performance of the growth strategies differed markedly with respect to the various indicators. It appeared that little was gained from using a stochastic model rather than a deterministic one.

Keywords: Farm growth; Linear programming; Simulation.

A number of studies of farm firm growth, involving a variety of models and techniques, have recently been reported (*3*, *4*, *5*, *8*, *9*, *10*). Much has been learned from these studies, but the results have often been conflicting and difficult to interpret, and the appropriateness of the alternative models requires further analysis. This study combines two techniques—simulation and linear programming—to model a southern Michigan dairy farm for the purposes of studying firm growth.

Alternative means to monitor growth include the measurement of inputs, assets or net worth, and output (*1*, *7*, *11*). None of the three has received universal acceptance. Inputs have qualitative variations that are difficult to discern with any degree of accuracy at a point in time or over time. Human agents and inputs that did not enter the market during the production period are examples. Inputs that are not acquired via the market during each production period also create problems of valuation. This is particularly true for services of real estate, valuation of which is often arbitrary.

Boussard (*2*) has a particularly interesting and scholarly treatise dealing with maximization of the firm's net worth at the end of the planning horizon, assuming a linear consumption function. However, factors such as the relation of family maturation and income level to the operator's marginal propensity to consume, the future development of new products, and reactions to national economic conditions must be weighed before accepting a linear consumption function.

Value of output is the measure of firm size used in this study. Value of output can be measured with relative accuracy and ease. Value of output reflects management input at all levels, including both production and marketing systems. It reflects the combined effects of exogenous forces and counteractions by management: A management input that can be detected in a comparative analysis. Value of output does not reflect the decline or accumulation of resource ownership, but ownership is a measure of wealth, not size.

To yield information of value, any model utilized in a growth study must possess several characteristics: (1) It must ensure continuity of operation from one production period to the next; (2) it must permit the approximation of relationships establishing the levels of endogenous variables to an acceptable degree, and effecting changes in these variables; and (3) it must include the more critical decision points and the major decision alternatives.[1]

The following analysis is based on a model consisting of a stochastic simulator interfaced with both an ex ante linear programming (LP) routine and an ex post LP routine, yielding a total of three different plans for each production period. Due to differences in assumptions regarding the state of knowledge, comparisons of plans permit analysis of managerial decisions.

The three plans are sets of production decisions and are determined as follows:

(a) *Ex ante LP plan.* Activity levels are determined by LP maximization of expected profits using mean values of stochastic variables. Profits are calculated using mean values of stochastic variables.

*Appreciation is extended to David L. Armstrong and Larry J. Connor, Michigan State University, for their critique of the initial draft and to several anonymous reviewers of a later draft. This article is a byproduct of the author's doctoral dissertation (*12*). Italic numbers in parentheses indicate items in the References, p. 103.

[1] The terminology used is intentionally nonspecific because what is critical or major depends upon objectives and resources available to achieve the objectives.

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(b) *Simulation plan.* Activity levels are based on representative production practices of southern Michigan dairy farmers. The effects of exogenous factors manifested through yields and prices are stochastically determined using probability functions in conjunction with a random number generator. Profits are calculated with randomly generated values of stochastic variables. Expected profits are also derived using the mean values of stochastic variables.

(c) *Ex post LP plan.* Activity levels are determined by LP maximization of profits using the randomly generated values of stochastic variables obtained for the simulation plan. Profits are calculated with the randomly generated values.

The stochastic simulator is the means for reflecting real world uncertainty.[2] The effects of uncertainty are ignored by a conventional LP model, which could be a serious weakness in a firm growth study if the farm operator is averse to high-risk situations. Also, LP models require modification if the operator seeks to achieve several objectives simultaneously without necessarily maximizing any one. The LP algorithm does provide a relatively efficient vehicle for analyzing a problem with respect to a single criterion. A variety of useful information may be obtained through the use of alternative objective functions and constraints, assuming such results are interpreted judiciously.

Simulation models are typically complex, with decision rules, discrete relationships, nonlinear functions, and multiple objectives. Consequently, interpretations with regard to any one objective are generally difficult, and costs of construction and operation rise rapidly as the number of objectives increases.

In this study, the simulator was the model's core, providing continuity of operation through the maintenance of inventory and capital accounts; effecting managerial decisions regarding the production mix, technology levels, and resource acquisition; and establishing the current conditions of the stochastic elements. Linear programming was utilized to derive two production plans specific to the current production period: the ex ante plan based on expectations[3] and the ex post plan based on the outcome of the stochastic elements, that is, perfect knowledge via hindsight.[4]

The ex ante LP derived production plan reflects the results of maximizing expected profits when uncertainty is disregarded. The ex post optimal production plan establishes a norm against which the performance of the other plans can be measured.

The simulator used in this study is a computerized farm firm model. Its components and relationships were designed to represent those that existed for southern Michigan farms during the study period. It contains land, livestock, and machinery purchasing activities with alternative financing arrangements. Numerous crop and livestock enterprises may be combined to meet the user's desires, with several technology levels available for each. Services of inputs, including land and labor, may also be purchased. Bookkeeping features maintain inventory records and capital accounts and compute enterprise profitability, depreciation, and net worth. The simulator automatically purchases replacement machinery within the guidelines established by the operator.

Price and yields are stochastic variables. Frequency or probability distributions for the variables are based on historical data. The possible outcomes of the random number generator are arranged in a similar distribution so that the number generated is associated with a value for the variable. When adverse conditions are simulated, unfavorable values are arbitrarily drawn from the extreme part of the probability distribution.

The LP models solve for production plans only, given a package of resources without regard to how they were acquired. The resource package in both LP plans is identical to that of the simulator. The price and yields of the ex post LP are also identical to those of the simulator, while the ex ante LP includes mean values for the prices and yields.

Procedure

The initial set of firm characteristics is simulated over a 10-year period under eight different managerial-strategy situations. The eight situations consist of two levels of managerial ability under each of four growth strategies. The two levels of managerial ability are hypothesized to be the above average and the exceptional (upper 5 percent). The four growth strategies consist of a vertical strategy (fixed land base) and three lateral strategies. Under the lateral strategies land is acquired by renting, land contract, or mortgage.

[2] Uncertainty is to be construed as imperfect knowledge of both the possible outcomes and the associated probabilities of occurrence from a specific, but yet to occur, set of conditions. Needless to say, the definition of the probability function is a crucial step in the construction of a stochastic model. The included probability functions, consisting of both commodity production and marketing conditions, were based on conditions existing in Michigan. A random number generator was the determinant of the specific value for a function.

[3] The weighted means of the probability functions were used.

[4] For information on the procedure for interfacing FORTRAN programs with the IBM LP package, see (*13*).

In the simulations, an ex ante LP solution is first obtained for each period using the mean values for the stochastic variables. Second, a set of decisions designed to represent the rather rigid cropping patterns of southern Michigan dairy farmers is simulated under stochastic conditions. Third, an ex post LP solution is derived using the perfect knowledge that exists through hindsight. This procedure is repeated in simulating each of the 10 years of operation.

Acquisition of cows and land is made in years 1, 6, and 10. Purchasing at intervals is considered to be more realistic than annual purchases. It gives firms a period of adjustment and possibly permits sufficient capital to be accumulated so that sizable quantities of land could be purchased at once. This is consistent with the typical pattern of expansion by absorbing existing operations. After each purchase year, as a separate phase of the analysis, each firm is subjected to 5 years of adverse conditions to gain an indication of the risk associated with each strategy.

Information Provided

Information covering three aspects of managerial decisions for firm growth is generated. First, the losses in potential income, relative to the maximum,[5] are partitioned into (1) that due to decisions known to be nonoptimal relative to the information available at the time[6] and (2) that due to the stochastic elements in exogenous forces. Second, the level of growth achieved by each management-strategy situation over a 10-year period is simulated. Third, the vulnerability of each situation under adverse conditions is assessed. The length of time each management level or growth strategy is able to survive bankruptcy in its several situations is used as a gage of its vulnerability, relative to the alternatives.

An annual loss, computed as the amount by which the maximum net income possible (ex post LP) exceeds the realized net income (simulator), occurs each year unless all random factors are correctly anticipated, either by chance or by foresight. Thus, the loss is always greater than, or equal to, zero. Similarly, that component of the loss due to incorrect decisions is always greater than, or equal to, zero; that is, nonoptimal decisions almost always result in losses.[7] In contrast, the effect of the stochastic elements may be positive, zero, or negative. A positive effect indicates that the occurring stochastic conditions favor the simulation plan: The loss expected from not following the ex ante optimal plan (incorrect decision) will be at least partially offset. An exact offsetting is possible but improbable. Otherwise, the loss expected from incorrect decisions will be aggravated.

The total loss is computed as the net income for the ex post optimal plan less the net income for the simulation plan. To get the incorrect decision component of the loss, the expected net income from the simulation plan is subtracted from the expected net income from the ex ante optimal plan.[8] The remaining component of the loss, that due to the stochastic elements, has two components: (1) The effect on the plan put into operation, and (2) the effect on the optimal plan. The former is computed as the difference between income expected and income realized from the simulation plan. The latter is the difference between the incomes of the ex ante optimal plan and the ex post optimal plan. It may be calculated simply by subtracting the incorrect decision component of the loss from the total loss. In either case, it may be positive, zero, or negative.

At this point, it is probably worthwhile to reemphasize the fact that annual net income is not the only objective to be considered in managing a firm bent on achieving growth. But the deviation of the income realized from the maximum is an indicator of some "costs" associated with the inclusion of additional objectives.

Results

When income lost through non-income-maximizing decisions over a 10-year period is partitioned into that due to incorrect decisions and that due to stochastic elements, the partitioning produces some interesting comparisons. For the eight managerial-strategy situations, the proportion due to "incorrect" decisions ranges from 79 percent to 91 percent, with an average of 87 percent weighted over all eight situations. Part of the income lost is knowingly foregone in deference to other objectives and part may result from erroneous decisions by farm managers, who perhaps had insufficient information.

To illustrate, a year-by-year breakdown is presented in table 1 for one of the eight managerial-strategy situations. This one combined the exceptional level of management and the acquisition of land by mortgage,

[5] The income to be had from correctly anticipating the exogenous factors.

[6] Optimality is used with reference to maximizing current net income. It is a benchmark indicating the net income sacrificed in bringing other objectives into the decision.

[7] Given that the respective probability functions are the best information available at decision time, optimal decision sets would be those based on weighted mean value, that is, over time, expectations would be for the highest average value for the objective.

[8] Expected net incomes are based on the weighted means of probability functions.

one of three lateral growth strategies. The fact that the effect of the stochastic elements is negative in a majority of the cases in table 1 should come as no surprise. The stochastic elements relating to the enterprises in the selected decision set must be the most favorable relative to all the other possible decision sets if the stochastic elements are to favor the set of decisions put into operation.

The results of this study pertaining to the relative strengths of the strategies in achieving growth and in withstanding adverse conditions are briefly summarized in table 2. Ownership, equity, and productive capacity are taken as three measures of size and thus of growth achieved. These measures are indicated by assets, net worth, and gross income, respectively.

Table 1.—Annual loss from nonoptimal solution: Total and amounts attributable to incorrect decisions and stochastic elements

Year	Annual loss	Incorrect decisions	Stochastic elements
1	–$3,602	–$2,389	–$1,213
2	–1,676	–2,046	+370
3	–4,013	–3,067	–946
4	–3,465	–2,607	–858
5	–2,902	–3,297	+395
6	–3,600	–4,504	+904
7	–5,856	–4,497	–1,359
8	–5,268	–4,148	–1,120
9	–6,611	–5,605	–1,006
10	–5,359	–4,347	–1,012
Total	42,352	36,507	5,845
Percent	100	86.2	13.8

Conclusions

This analysis resulted in consequential findings in two important areas. One is in relation to the relative strengths and weaknesses of four common growth strategies. The second deals with an evaluation of the merits of a stochastic model as opposed to a deterministic model.

The analysis of the four types of strategies is divided into two parts: (1) What are the relative potentials for growth of the four strategies, and (2) what are their relative strengths under adverse conditions? The conclusion is that no single strategy is superior to the other three under both tests.

Expanding laterally by means of a land contract arrangement turned out to be the best all-around strategy. It captures the leadership position in achieving growth and demonstrates substantial strength in withstanding adverse conditions.

Purchasing land under a contract offers certain advantages to farmers if such an arrangement is available. With the small downpayment requirements, the contract offers the potential either to acquire control of additional land or to release additional funds for other uses. The land contract does, however, present the imprudent operator with a means to financial ruin through too much indebtedness. With reasonable use, it offers the opportunity to acquire additional resources beyond what could be purchased with larger down payments required in mortgaging. This consideration can be particularly important in the case of assets subject to capital gains.

The vertical strategy is the most resilient in the face of adversity but is more restrictive than two of the other

Table 2.—Summary comparison of strategies[a]

Item	10-year growth			5-year resistance[b]	Annual net cash income
	Ownership	Equity	Productive capacity		
Vertical	–	+	–	++	0
Renting	–	+	++	--	0
Land contract	++	++	+	+	++
Mortgage	+	++	+	+	+

[a] This table represents a set of qualitative judgments on the part of the author regarding the relative positions of the strategies under certain specified measures. A mark of (++) is given to the top-ranked strategy and the other three are assigned one of the following marks: (+), (0), (–), or (--) according to their position in relation to the one with the highest rank. There were two managerial-strategy situations involving above average and exceptional management available for evaluating each strategy. Exceptional management exhibited superior performance under each measure but the above results hold equally for both types of management.

[b] Resistance to bankruptcy under conditions of adversity.

strategies in achieving growth. Expansion by renting land under a long-term contract is the weakest strategy, considering both factors. Firms adopting this strategy are always the first to succumb to adverse conditions. The success of the strategy necessitates the maintenance of a substantial cash flow and adverse conditions reduce the cash flow.

The attempt to compare the growth potential of alternative growth strategies is not original. On the other hand, evaluation of the ability of firms operating under a particular strategy to withstand adverse conditions has not often been made. The study indicates that there is definitely a wide variation among strategies with regard to this characteristic, and it would appear that this aspect would deserve a great deal of consideration from an operator planning to commit large sums of money to growth. This is a particularly important finding in view of several possibilities now facing commercial farmers: (1) Future technological innovations could result in substantial outward shifts in the supply curve for agricultural commodities, (2) the development of substitutes is an ever-present threat, and (3) drastic change in Government policy is a possibility constantly facing agriculture. Any of these three factors, and perhaps others, could put agricultural producers in a difficult position for a long time as part of an adjustment process that would very likely see a number of operations fail. Operators planning to invest several hundred thousand dollars should be made aware of the variations in the risk associated with the different strategies.

The partitioning of the income loss from decisions that were nonoptimal in an ex post sense has implications for both dairy farmers and economic researchers. Given a bundle of assets and a set of production decisions, variations in stochastic elements generally had very little impact on the growth of a southern Michigan dairy farm during a 1-year period. Also, the net effect of stochastic elements over a longer period was small, as the offsetting effects among enterprises and among years tended to cancel out.

The fact that the net effect of stochastic elements was inconsequential—that is, the effect was similar to using means in a deterministic model—is not surprising, given the diversity of the dairy operation. Even with diversity limited to milk, hay, and several types of grain, adverse production or marketing conditions in one commodity were typically offset by more favorable conditions soon thereafter, if not in the same calendar year.

In retrospect, it appears that little was gained from using a stochastic model as opposed to a deterministic one. This is not to say that knowledge concerning the dispersion and probability of occurrence for exogenous forces is not important. These two types of information are invaluable to the success of both the firm and an analysis of its operation. But computer resources could have been utilized more efficiently by using predetermined sets of exogenous forces to test the particular hypotheses under study. The value of the frequency distributions would be in the design stage when the sets of exogenous forces were selected.

Admittedly, the impact of exogenous forces is likely to become more pronounced as the degree of diversity in the firm's operations diminishes, but a stochastic model will not necessarily permit a better analysis. Analysis based on probability distributions requires that either some minimum number of values be drawn from the distribution or that the probability of occurrence be considered in the analysis. For future research, consideration should be given to limiting the use of probability or frequency distributions to the design and analysis stages in a project. Not only may more efficient use be made of computer resources in conducting the analysis, but considerable savings may result from constructing deterministic models as opposed to stochastic models.

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Oats and Barley Acreage Response to Government Programs*

By Mary E. Ryan and Martin E. Abel

This research completes a series of estimates of supply relationships for corn, sorghum, oats, and barley. (See M. E. Ryan and M. E. Abel, "Corn Acreage Response . . .," *Agr. Econ. Res.* 24(4); 102-112, Oct. 1972, and "Supply Response of U.S. Sorghum Acreage . . .," *Agr. Econ. Res.* 25(2); 45-55, April 1973). Special emphasis is on measurement and analysis of the effects of Government commodity programs on acreage planted to each crop. The model developed was employed to estimate 1972 acreage. Actual and estimated values are 20.5 and 20.6 million acres, respectively, for oats and 10.5 and 10.0 million acres, respectively, for barley.

Key words: U.S. oats supply; U.S. barley supply; Government programs; policy analysis; acreage response; regression analysis.

The research reported in this paper completes a series of estimates of supply relationships since World War II for the four major feed grains—corn, sorghum, oats, and barley.[1] These four commodities account for about 95 percent of the grain fed to U.S. livestock. In each of the past 2 years, they have earned more than $1 billion for U.S. farmers from export sales. This strong demand has been accompanied by remarkable advances in feed grain technology that have more than doubled yields per acre since World War II. The resulting surge in supply has exceeded growth in demand, leading to downward pressure on feed grain prices and on incomes of producers in many recent years. To partially counteract these forces, the Government instituted supply restricting programs to limit output when burdensome surpluses threatened.

Because of the influence of Government policies during the past two decades, special emphasis in this research is on empirical measurement and analysis of the effects of Government policies and programs on feed grain acreage. A theoretical model was developed for the analyses of corn and sorghums, and it is here applied to estimate acreage supply functions for oats and barley.[2]

The Setting

Acreage, Yield, and Production. Figure 1 illustrates changes in acreage planted to oats and barley in the United States and for the crops with which they mainly compete for production resources. The most marked trends are the contraction in oat acreage beginning in 1956 and the steady expansion in acreage planted to soybeans. Although plantings of corn and wheat declined during the 1950's, no trends seem apparent since then. Acreage planted to barley is now at about the same level as at the beginning of the study period. However, from 1954 until the early 1960's, considerably more acreage was devoted to barley. During many of these years planting restrictions were imposed on wheat and corn but not on barley. Acreage began to be withdrawn from barley when Government land-rental programs were established in the early 1960's.

National average yields of oats, barley, corn, wheat, and soybeans are given in figure 2. Though yields have increased for all crops since 1949, the advances for corn are most prominent. (The sharp dip in 1970 resulted from widespread occurrence of corn blight, and drought in the western Corn Belt.) Yield increases for oats and

*University of Minnesota Agricultural Experiment Station Scientific Journal Series 8388. We wish to acknowledge helpful comments received from several staff members of the Department of Agricultural and Applied Economics, University of Minnesota.

[1] Previous work has been reported in J. P. Houck and M. E. Ryan, "Supply Analysis for Corn in the United States: The Impact of Changing Government Programs," Amer. Jour. Agr. Econ. 54:184-191, May 1972; M. E. Ryan and M. E. Abel, "Corn Acreage Response and the Set-Aside Program," Agr. Econ. Res. 24:102-112, October 1972; and M. E. Ryan and M. E. Abel, "Supply Response of U.S. Sorghum Acreage to Government Programs," Agr. Econ. Res. 25:45-55, April 1973.

[2] The model may be expressed as

$$A = f(PF, DP, Z)$$

where A is acreage planted; PF is the support price weighted by planting restriction, if any; DP represents payment for land withheld from production of the crop; and Z includes other supply determinants and random factors. See earlier work referred to in footnote 1 for a complete discussion of the model and for a description of how the policy variables, PF and DP, are constructed.

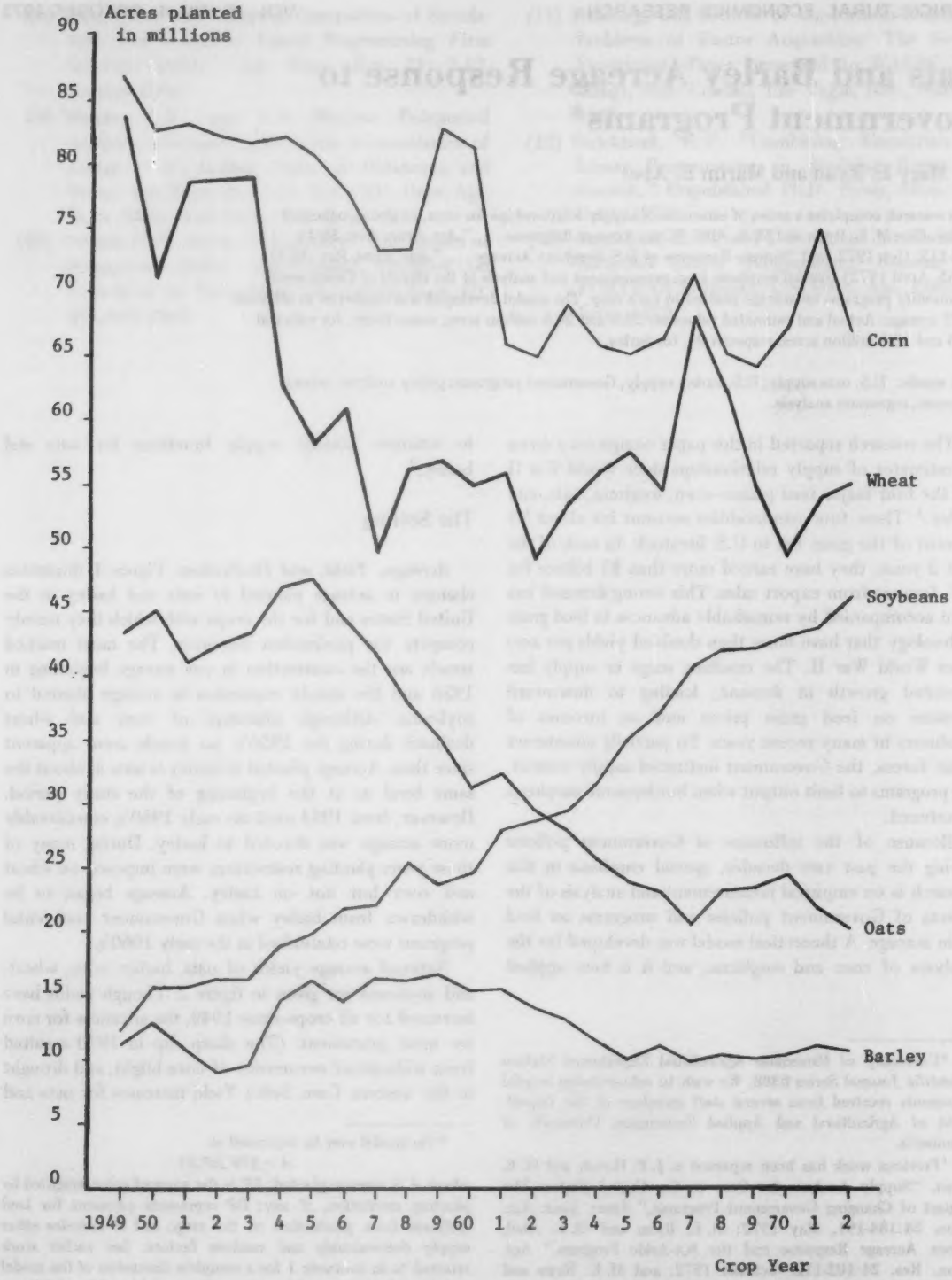

Figure 1. U.S. acreage planted to oats, barley, corn, wheat, and soybeans, 1949-72.

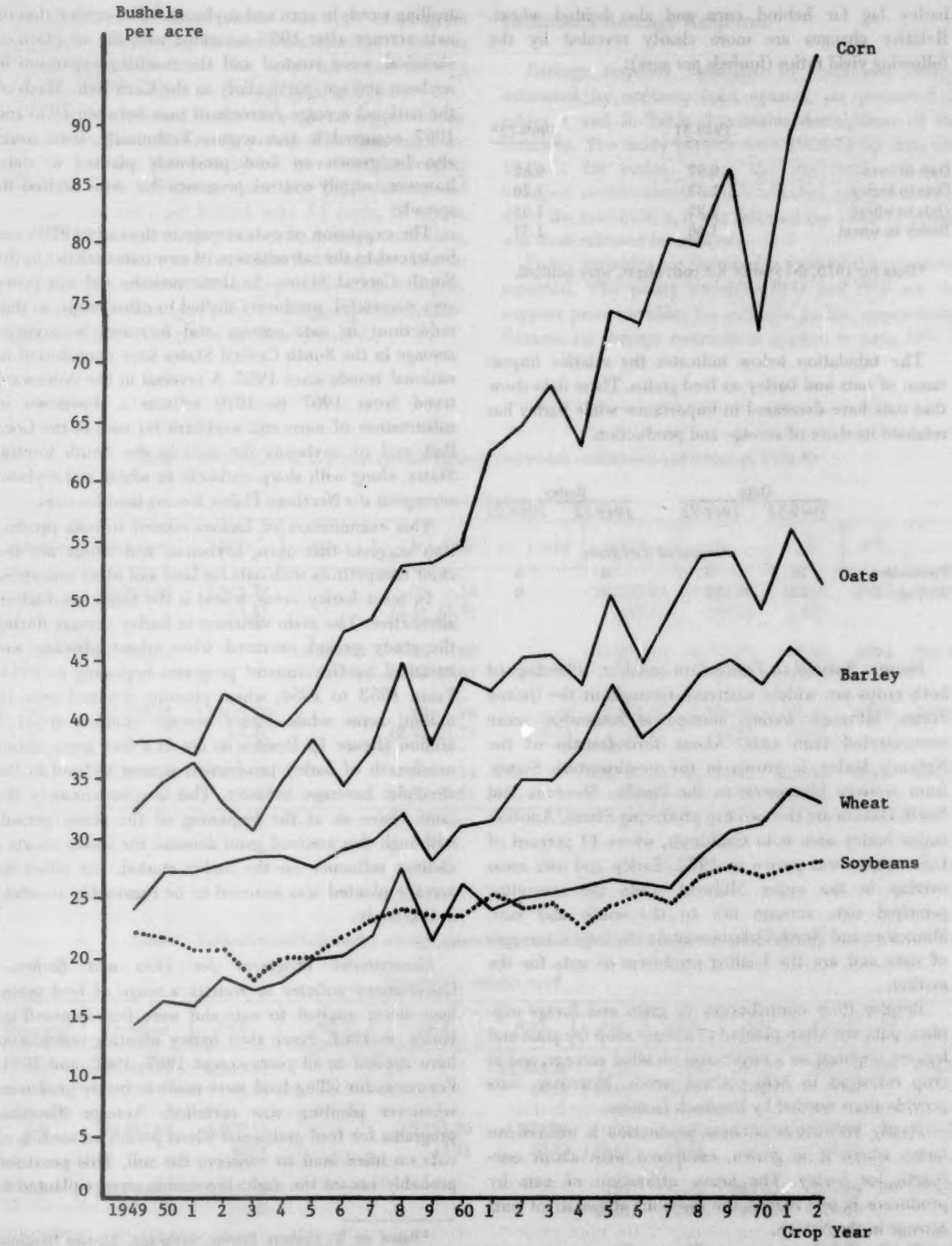

Figure 2. U.S. average yields for oats, barley, corn, wheat, and soybeans, 1949-72.

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barley lag far behind corn and also behind wheat. Relative changes are more clearly revealed by the following yield ratios (bushels per acre):

	1949-51	1969-72*
Oats to corn	0.92	0.62
Oats to barley	1.33	1.20
Oats to wheat	2.21	1.65
Barley to wheat	1.66	1.37

*Data for 1970, the year of the corn blight, were omitted.

The tabulation below indicates the relative importance of oats and barley as feed grains. These data show that oats have decreased in importance while barley has retained its share of acreage and production.

	Oats		Barley	
	1949-53	*1969-72*	*1949-53*	*1969-72*
	Percent of feed grain			
Production	18	8	6	6
Acreage	29	19	7	8

Factors Related to Production and Use.—Plantings of both crops are widely scattered throughout the United States, although barley acreage is somewhat more concentrated than oats. About three-fourths of the Nation's barley is grown in the northwestern States, from western Minnesota to the Pacific. Montana and North Dakota are the two top producing States. Another major barley area is in California, where 11 percent of U.S. output was grown in 1972. Barley and oats areas overlap in the upper Midwest while the remaining principal oats acreage lies to the south and east. Minnesota and North Dakota contain the largest acreages of oats and are the leading producers of oats for the market.

Besides their contribution to grain and forage supplies, oats are often planted as a nurse crop for grass and legume seedings, as a cover crop on idled acreage, and in crop rotations to help control weeds. Moreover, oats provide straw needed by livestock farmers.

Nearly two-thirds of oats production is utilized on farms where it is grown, compared with about one-fourth for barley. The heavy utilization of oats by producers is one reason for the wide dispersal of oats acreage in the Nation.

The need for oats in crop rotations began to taper off when herbicides became generally available for controlling weeds in corn and soybeans.[3] The contraction of oats acreage after 1955 coincided with the adoption of chemical weed control and the resulting expansion in soybean acreage, particularly in the Corn Belt. Much of the national acreage decrease of oats between 1955 and 1967 occurred in this region. Technically, corn could also be grown on land previously planted to oats; however, supply-control programs for corn limited its spread.

The expansion of oats acreage in the early 1950's can be traced to the introduction of new oats varieties in the South Central States. As these varieties did not prove very successful, producers shifted to other crops, so that reductions in oats acreage and increases in soybean acreage in the South Central States have contributed to national trends since 1955. A reversal in the downward trend from 1967 to 1970 reflects a slowdown in substitution of corn and soybeans for oats in the Corn Belt and of soybeans for oats in the South Central States, along with sharp cutbacks in wheat and soybean acreage in the Northern Plains, freeing land for oats.

This examination of factors related to oats production suggests that corn, soybeans, and wheat are the chief competitors with oats for land and other resources.

In most barley areas, wheat is the major production alternative. The main variation in barley acreage during the study period occurred when wheat planting was curtailed by Government programs beginning in 1954. From 1953 to 1954, wheat planting dropped over 16 million acres while barley acreage climbed about 5 million (figure 1). Besides its use as a feed grain, about one-fourth of barley production is now utilized in the alcoholic beverage industry. This is approximately the same share as at the beginning of the study period. Although this nonfeed grain demand for barley exerts a distinct influence on the barley market, the effect on acreage planted was assumed to be reasonably constant in this study.

Government Programs for Oats and Barley.—Government policies to restrict acreage of feed grains have never applied to oats and were first imposed on barley in 1962. Since then barley planting restrictions have applied in all years except 1967, 1968, and 1971. Payments for idling land were made to barley producers whenever planting was curtailed. Acreage diversion programs for feed grains and wheat permitted seeding of oats on idled land to conserve the soil. This provision probably caused the slight increase in acreage planted to

[3] Based on W. Herbert Brown, Soybeans: Acreage Response to Price and Farm Program Changes, ERS-473, U.S. Dept. Agr., July 1971, and private discussions with Brown.

oats in 1961, the first year of this type of program (figure 1). (Harvesting of oats from diverted acres was not permitted. Statistics for acres harvested show a decrease of 2.7 million acres from 1960 to 1961.)

Prices of oats and barley have been supported by loans throughout the study period. The loan rates are tied to the corn loan rate by law to reflect the feeding values of each, relative to corn. For 1972 the national average loan rates per bushel were 54 cents, 86 cents, and $1.05, respectively, for oats, barley, and corn. Moreover, the loan rate for wheat has been set close to its feed value since 1964, making wheat more competitive with the coarse grains for feeding purposes. Similarly, market prices for grains are closely linked.

Estimated Acreage Response

Acreage response equations for oats and barley, estimated by ordinary least squares, are presented in tables 1 and 2. Table 3 contains descriptions of the variables. The study periods were 1956-71 for oats and 1949-71 for barley. Given the structural and technological developments which affected oats production since the mid-1950's, it was felt that the 1956-71 period was most relevant for analysis.

Policy variables are included in most of the equations reported. The policy variables *PFO* and *PFB* are the support price variables for oats and barley, respectively. Because no acreage restrictions applied to oats, *PFO* is

Table 1.–Estimation of U.S. oats acreage planted, (regression coefficients and *t*-values), 1956-71

Dependent variable = *AO*

Equation	Constant	*PFO*	PO_{t-1}	*AW*	*AWD*	*AC*	*ASB*	*DV68*	*T*	T^2	R^2	*s*
1-1	54,369.60	13,919.77		–.26	–.14			–23,989.83	–3,625.80	128.24	.9965	555.83
		(4.4)		(2.4)	(1.7)			(35.1)	(10.5)	(4.3)		
1-2	63,745.43		–5,239.45	–.22	–.09			–24,455.34	–3,771.31	141.41	.9894	968.40
			(0.6)	(1.2)	(0.6)			(20.5)	(6.3)	(2.8)		
1-3	53,702.24	13,896.03		–.28	–.16		–.09	–25,961.38	–3,684.76	121.57	.9966	581.57
		(4.2)		(2.3)	(1.7)		(0.5)	(6.1)	(9.6)	(3.6)		
1-4	60,604.34	9,283.40		–.24	–.13	–.05		–24,728.86	–3,767.43	134.94	.9968	563.87
		(1.5)		(2.2)	(1.6)	(0.9)		(22.4)	(9.7)	(4.3)		

Table 2.–Estimation of U.S. barley acreage planted (regression coefficients and *t*-values), 1949-71

Dependent variable = *AB*

Equation	Constant	*PFB*	PB_{t-1}	*DPB*	*PFO*	*AW*	*AWD*	*DV*	*YEAR*	R^2	*s*
2-1	56,195.40	4,335.81			–13,005.52	–.31	–.13	397.75	–330.58	.95	670.74
		(3.2)			(4.5)	(10.0)	(3.0)	(0.6)	(5.4)		
2-2	59,697.62	–4,078.11		–19,551.26	– 1,871.94	–.30	–.10	477.26	–378.83	.96	621.25
		(0.9)		(1.9)	(0.3)	(10.6)	(2.6)	(0.8)	(6.1)		
2-3	53,710.15	2,733.37				–.37	–.20	669.05	–335.84	.89	973.63
		(1.4)				(9.5)	(3.5)	(0.7)	(3.8)		
2-4	55,427.00		–3,169.90			–.29	–.18		–345.20	.88	996.06
			(1.1)			(6.7)	(3.2)		(7.4)		

Table 3.—Variable descriptions

AB	=	U.S. acreage of barley planted, in thousands
AC	=	U.S. acreage of corn planted, in thousands
AO	=	U.S. acreage of oats planted, in thousands
ASB	=	U.S. acreage of soybeans planted, in thousands
AW	=	U.S. acreage of wheat planted, in thousands
AWD	=	U.S. acreage of diverted under wheat programs, in thousands
DPB	=	barley acreage diversion payment rate, weighted by eligible diversion acreage, dollars per bushel
DV	=	0 in 1957-65 and 1 in 1966-71, to account for a change beginning in 1966 when support payments were shifted from *PF* to *DP*
$DV68$	=	0 in 1956-67 and 1 in 1968-71
PB_{t-1}	=	lagged barley market price received by farmers, dollars per bushel
PFB	=	U.S. average barley loan rate (plus direct support payments, 1963-65) weighted by acreage restriction requirements, dollars per bushel
PFO	=	U.S. average oats loan rate weighted by acreage restriction requirements, dollars per bushel
PO_{t-1}	=	lagged oats market price received by farmers, dollars per bushel
T	=	linear trend; 1956 = 1, 1957 = 2, etc.
T^2	=	T squared; 1956 = 1, 1957 = 4, etc.
$YEAR$	=	linear trend; 1949 = 49, 1950 = 50, etc.
s	=	standard error of the estimate

the loan rate. For barley, the loan rate has been adjusted downward to obtain *PFB* for those years in which planting was curtailed. The variable *DPB* is the diversion payment variable for barley. Since there were no diversion programs for oats, there is not a corresponding variable for oats. These policy variables are constructed in exactly the same manner as the policy variables employed in the corn and sorghum studies cited in footnote 1. The data for these and the other variables used in the analysis are in the appendix table.

Oats Results.—Equation 1-1 in table 1 provides a good historic description of acreage planted to oats, AO; the signs of the estimated coefficients are consistent with prior expectations, the t-values of the regression coefficients are relatively large, and the overall fit of the equation, indicated by R^2, is exceptionally good. It contains the policy variable, *PFO*, two variables to measure the effect of substitution between oats and wheat (*AW* and *AWD*), and three variables (T, T^2, and *DV*68) to capture various trend influences in the study period. Actual and estimated values of AO based on equation 1-1 are shown in figure 3.

The policy variable, *PFO*, has a strong, positive relationship with acreage planted to oats. A 10-cent-per-bushel increase in the loan rate for oats, ceterus paribus, is associated with an increase in AO of about 1.4 million acres. Possible effect of the lagged market price of oats, PO_{t-1}, is also investigated (equation 1-2) but the coefficient of PO_{t-1} is not significant. In a preliminary estimation, PO_{t-1} was added to equation 1-1. The result was a negative coefficient for PO_{t-1}, similar in size and significance to that of equation 1-2; the other variables in the equation were not appreciably affected by the addition of PO_{t-1}. The superiority of the price support variable to lagged market price was consistent with previous results obtained for corn and sorghum.

Acreage planted to wheat (*AW*) and acreage idled under the wheat programs (*AWD*) are important variables in all specifications. Changes in *AW* are associated with changes in AO of about 25 percent in the opposite direction—a 100-acre increase in wheat decreases oats acreage by about 25 acres. The effect on oats plantings of acreage idled under wheat programs is about half the size of the effect of wheat acreage planted. This result is consistent with the "slippage" phenomenon observed in acreage diversion programs in which changes in acres diverted are roughly one-half as great as opposite changes in acres planted to a given crop.

It is postulated that soybeans and corn, as well as wheat, compete with oats for production resources. In equations 1-3 and 1-4, acreage planted to soybeans, *ASB*, and acreage planted to corn, *AC*, are entered as possible means of capturing such substitution. Neither of these specifications results in significant relationships between oats and these competing crops. It is quite likely that substitution between acreages of oats and corn or soybeans is being picked up by the trend variables. Nevertheless, replacement of the trend variables by *ASB* or *AC*, or both, does not result in as statistically significant an equation as 1-1. Regressions were also estimated that included variables representing price supports for corn and soybeans, acreage diversion payments for corn, and total acreage diverted under feed grain programs. These alternative formulations did not improve upon the explanatory power of the reported equations.

The rationale underlying the trend variables is as follows: The factors influencing the rapid shift away from oats beginning in the mid-1950's (the adoption of chemical weed control in corn and soybean production and the limited success of southern varieties of oats) were likely to decrease through time; that is, in the first

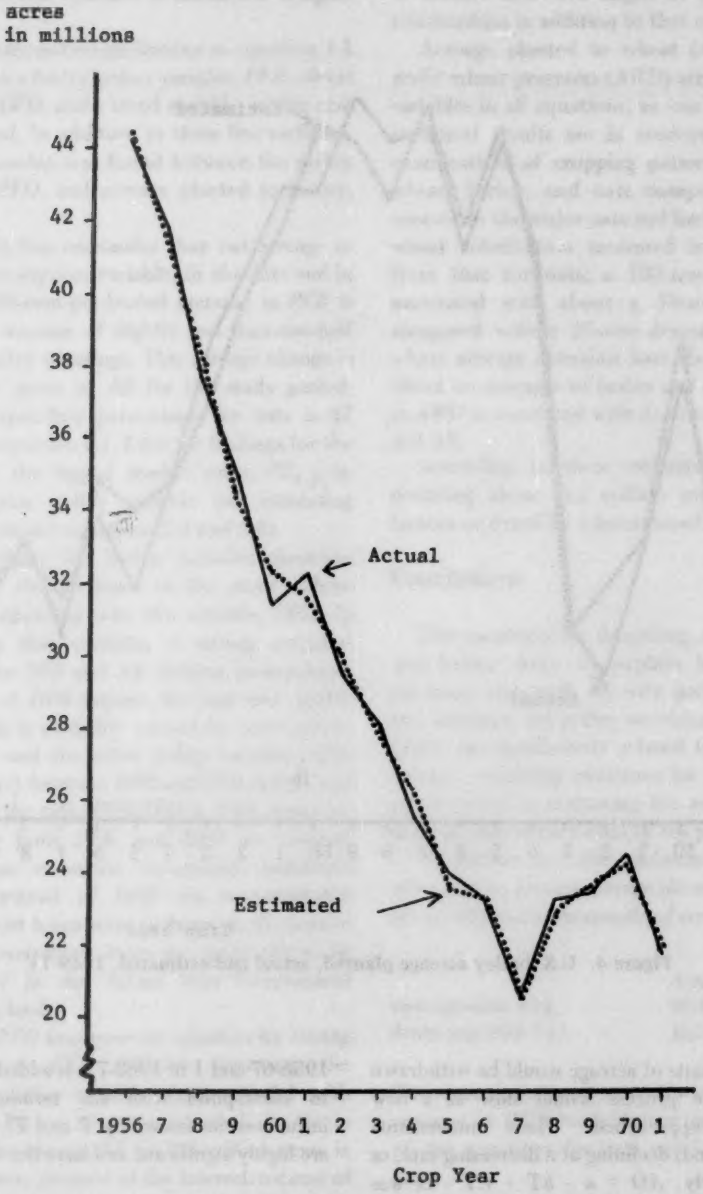

Figure 3. U.S. oats acreage planted, actual and estimated, 1956-71.

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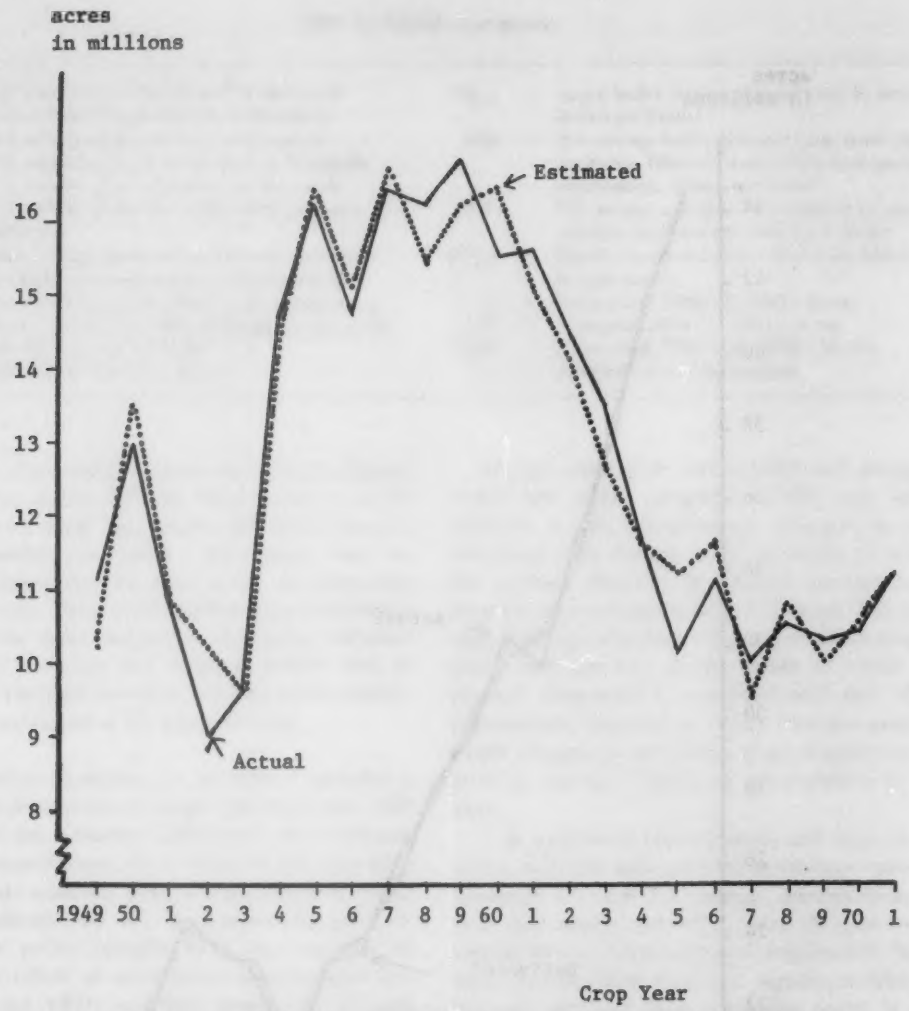

Figure 4. U.S. barley acreage planted, actual and estimated, 1949-71.

few years, large amounts of acreage would be withdrawn from oats, then the process would slow as a new equilibrium was approached. These movements would result in a trend, declining at a decreasing rate, or expressed algebraically, $AO = a - bT + CT^2$. It was presumed that this process took about a decade, ending in 1967, based on the observation that both oats and soybean acreage leveled off somewhat in the late 1960's (figure 1). To measure this complex relationship, two trend variables, T and T^2, are included in each regression, where T is a linear trend, assigned the values of 1 in 1956, 2 in 1957, . . . 12 in 1967, and T^2 is the square of T, equal to 1 in 1956, 4 in 1957, ... 144 in 1967. A dummy variable, $DV68$, which takes values of zero in 1956-67 and 1 in 1968-71, is added to shift the intercept to correspond with the termination of the trend influences measured by T and T^2.[4] The trend variables are highly significant and have the expected signs.

Barley Results.—Equation 2-1 is perhaps the best equation in table 2 for describing acreage planted to barley, AB. The signs of the estimated coefficients conform with economic theory. The significance of the coefficients, indicated by t-values, is fairly high, and the R^2 signifies that 95 percent of the variation in AB is

[4] Separate analyses of trend behavior confirm the absence of trend in 1968-71.

accounted for by the six selected independent variables. The performance of this equation is illustrated in figure 4.

Equation 2-1 bears several similarities to equation 1-1 for oats. It contains a barley policy variable, *PFB*, wheat variables *AW* and *AWD*, and a trend variable, in this case a simple linear trend. In addition to these five variables, a significant relationship was found between the policy variable for oats, *PFO*, and acreage planted to barley, *AB*.

Barley acreage is less responsive than oat acreage to changes in the price support variable, in absolute and in relative terms. A 10-cent-per-bushel increase in *PFB* is associated with an increase of slightly less than one-half million acres in barley plantings. This acreage change is 34 percent of the mean of *AB* for the study period, whereas the corresponding percentage for oats is 47 percent, based on equation 1-1. Like the findings for the other feed grains, the lagged market price, PB_{t-1}, is inferior to the price policy variable for estimating acreage planted (compare equations 2-3 and 2-4).

Government policies for barley included diversion payments in 7 of the 23 years of the study. These payments are incorporated into the variable, *DPB*. In models containing this variable, a strong, negative relationship between *DPB* and *AB* obtains, as expected, but the inclusion of *DPB* impairs the sign and significance of *PFB*. This is probably caused by intercorrelation between *DPB* and the other policy variables. The simple correlation (r) between *DPB* and *PFB* is 0.83 and between *DPB* and the ratio *PFB/PFO* is 0.98. Since no models containing both *PFB* and *DPB* are entirely consistent from an economic standpoint, equations containing *PFB* instead of *DPB* are recommended because price support loans were in force in all years of the study, and Government loans are more apt to be continued annually in the future than Government payments for idling land.

The addition of *PFO* improves the equation by raising the significance of *PFB* without lessening the significance of the other variables (compare 2-1 with 2-3). In equation 2-1, a 10-cent-per-bushel change in *PFO* is estimated to change *AB* by 1.3 million acres in the opposite direction. Because of the interrelatedness of loan rates among the major grains, it is not unreasonable to assume that *PFO* might be picking up substitution relationships in addition to that of oats.

Acreage planted to wheat (*AW*) and acreage idled under wheat programs (*AWD*) are important explanatory variables in all equations, as was the case for oats. These statistical results are in conformance with the earlier examination of cropping patterns that suggested that wheat, barley, and oats compete for production resources in the major oats and barley areas. The degree of wheat substitution measured is not greatly different from that for oats; a 100-acre increase in wheat is associated with about a 30-acre decrease in barley compared with a 25-acre decrease in oats. Changes in wheat acreage diversion have about the same estimated effect on acreages of barley and oats—a 10-acre increase in *AWD* is associated with decreases of 1 acre each in *AO* and *AB*.

According to these estimates, barley plantings are declining about 0.3 million acres annually owing to factors captured by a linear trend.

Conclusions

The equations for describing acreages planted to oats and barley seem to explain historical variations in plantings very well. As with previous analyses for corn and sorghum, the policy variables employed for oats and barley are significantly related to acreage planted. The acreage estimating equations for oats and barley should prove useful in evaluating the acreage planted implications of alternative values of the policy variables.

To further test the usefulness of the models, they were used to predict acreage planted in 1972. The results are as follows (in thousands of acres):

	Actual	*Predicted*
Oats (equation 1-1)	20,495	20,614
Barley (equation 2-1)	10,548	10,000

The close correspondence between actual and predicted acreages in 1972 lends further support to the usefullness of the equations for oats and barley presented in this paper.

Appendix Table: Data Series

Crop year	*AO*	*AB*	*PFO*	PO_{t-1}	*PFB*	PB_{t-1}	*DPB*	*AW*	*AWD*	*AC*	*ASB*	*DV*	*DV68*	*T*	T^2	*YEAR*
1949	43,132	11,132	0.69	0.717	1.09	1.16	0.0	83,905	0	86,738	12,456	0	0			49
1950	45,044	13,010	0.71	0.655	1.10	1.06	0.0	71,287	0	82,859	15,640	0	0			50
1951	41,015	10,790	0.72	0.788	1.11	1.19	0.0	78,524	0	83,275	15,655	0	0			51
1952	42,341	9,190	0.78	0.820	1.22	1.26	0.0	78,645	0	82,230	16,374	0	0			52
1953	43,220	9,616	0.80	0.789	1.24	1.37	0.0	78,931	0	81,574	16,719	0	0			53
1954	46,898	14,740	0.75	0.742	1.15	1.17	0.0	62,539	0	82,185	18,872	0	0			54
1955	47,494	16,293	0.61	0.714	0.95	1.09	0.0	58,246	0	80,932	19,981	0	0			55
1956	44,205	14,732	0.65	0.600	1.02	0.92	0.0	60,655	0	77,828	21,998	0	0	1	1	56
1957	41,840	16,398	0.61	0.686	0.94	0.99	0.0	49,843	12,800	73,180	22,186	0	0	2	4	57
1958	37,699	16,150	0.61	0.605	0.93	0.89	0.0	56,017	5,300	73,351	25,350	0	0	3	9	58
1959	35,064	16,766	0.50	0.578	0.77	0.90	0.0	56,706	0	82,742	23,579	0	0	4	16	59
1960	31,419	15,527	0.50	0.646	0.77	0.86	0.0	54,906	0	81,425	24,649	0	0	5	25	60
1961	32,314	15,623	0.62	0.599	0.93	0.84	0.0	55,707	0	65,919	27,981	0	0	6	36	61
1962	29,500	14,380	0.62	0.642	0.65	0.98	0.149	49,274	10,700	65,017	28,593	0	0	7	49	62
1963	28,054	13,452	0.65	0.624	0.67	0.92	0.086	53,364	7,200	68,771	29,598	0	0	8	64	63
1964	25,634	11,652	0.65	0.622	0.62	0.90	0.139	55,672	5,100	65,823	31,794	0	0	9	81	64
1965	24,010	10,099	0.60	0.631	0.62	0.95	0.139	57,361	7,200	65,119	35,227	0	0	10	100	65
1966	23,301	11,134	0.60	0.622	0.52	1.02	0.175	54,395	8,300	66,306	37,294	1	0	11	121	66
1967	20,646	10,002	0.63	0.655	0.90	1.05	0.0	67,796	0	71,093	40,776	1	0	12	144	67
1968	23,166	10,477	0.63	0.659	0.90	1.00	0.0	62,486	0	65,126	42,037	1	1	0	0	68
1969	23,532	10,311	0.63	0.599	0.54	0.91	0.170	54,279	11,100	64,476	42,198	1	1	0	0	69
1970	24,492	10,435	0.63	0.586	0.54	0.87	0.162	49,488	15,700	67,352	43,332	1	1	0	0	70
1971	21,926	11,182	0.54	0.626	0.81	0.96	0.0	54,643	13,700	74,651	43,637	1	1	0	0	71

AO = oats acreage planted, in thousands
AB = barley acreage planted, in thousands
PFO = support price for oats, dollars per bushel
PO_{t-1} = lagged market price for oats, dollars per bushel
PFB = weighted support price for barley, dollars per bushel
PB_{t-1} = lagged market price for barley, dollars per bushel
DPB = weighted diversion payment rate for barley, dollars per bushel

AW = wheat acreage planted, in thousands
AWD = wheat acreage diverted, in thousands
AFGD = feed grain acreage diverted, in thousands
ACT = cotton acreage planted, in thousands
AC = corn acreage planted, in thousands
ASB = soybean acreage planted, in thousands

BOOK REVIEWS

Resource Allocation in Agricultural Research

Edited by Walter L. Fishel, University of Minnesota Press, Minneapolis 55455. 391 pages. 1971. $14.

For the economist, the theoretical criterion for allocating resources to agricultural research is straightforward. But while he can outline the model for determining optimal resource allocation, it is impossible to empirically define and fit the model. How, then, should the resource allocation problem be conceptualized and addressed? This book focuses on that question.

The volume is based on papers presented at the Minnesota Symposium on Resource Allocation in Agricultural Research held in Minneapolis on February 23-25, 1969, and jointly sponsored by the Agricultural Experiment Station of the University of Minnesota and USDA's Cooperative State Research Service. The objective of the symposium was to identify the state of the arts in resource allocation. The symposium participants included many of the scientists and administrators who have been directly involved in studies investigating various aspects of returns to investments in agricultural research, both before and after its conduct, as well as experimenting in applying formal operational allocation procedures to existing decisionmaking processes in research.

The book is organized around five major topics. Part I presents an overview of the entire question of resource allocation for research, with material drawn from the remaining chapters and the symposium discussions. Tichenor and Ruttan outline a number of the principal problems and issues, while Tweeten, using what crude measures are available, demonstrates that the rate of return on investment in research appears to be substantially higher than in other sectors of the economy. He suggests that the impact of the knowledge industry on the distribution of income, on national and world unrest, and on other aspects of our value structure poses a major challenge to the thinking of sociologists, political scientists, and philosophers as well as economists.

Part II provides foundations for the later sections by considering the reasons for research, what research tries to accomplish, alternative bases for placing value on research results, and many environmental factors affecting or affected by allocation decisions. Kaldor pleads for legislative attention to the problem of formulating a rigorous and operationally useful social objective function. He suggests that investigation of many questions raised by the problem could have large social payoffs if they were to lead to a clearer indication of society's goals and valuations. Paulson discusses what may be called "pricing the research output," and argues that: It's done all the time; it is relevant since the outcome of research expenditures is not purely random and all information is not equal in value; pricing of research can be approached scientifically by creating or simulating the market; having legally constituted representatives of society price research output is probably less invidious than having fellow scientists provide the only indication of worth; and a larger absolute social return might result from indicators of social value which would lead to better allocation of research resources. Schultz discusses the economic attributes of research, and determinants of demand and supply that explain the behavior of nonprofit research agents; he advances a number of propositions and their implications. Heady centers his attention on welfare implications of agricultural research, and emphasizes the great need for a broad delineation of equity problems by agricultural research scientists and administrators as well as for the continued development of models of resource allocations to provide equitable distributions on the gains from farm technological advances.

Part III considers historical evidence of the productivity of agricultural research in the United States and the attempts to determine the factors associated with more productive as contrasted to less productive research activities. Peterson reviews recent empirical studies on the measurement of returns to investment in agricultural research, and observes a relatively small dispersion among the estimates. While the payoff is high, he feels two gaps need filling: What is the distribution effect of technological change, and what is the social cost of agricultural research above the value of resources used in the research process. Evenson concludes that (1) economies of scale exist in State agricultural experiment stations, (2) a strong graduate program improves the productivity of research, and (3) productivity is highest in the stations with highest faculty salaries. Welch

submits that technical change exerts pressure on labor to leave agriculture, and education has always been one of the more important vehicles of exit. Yet, because technical change increases production uncertainty, it creates a demand for discretionary capabilities associated with education, and therefore retards the exit of persons who otherwise would be the first to leave.

Part IV turns to the more pragmatic and less conceptual considerations of how, in fact, allocation decisions are currently made in the principal public organizations concerned with agricultural research. Hurter and Rubenstein judge that allocation models are of little value in the private sector, while McGregor, Office of Management and Budget, and Bayley, USDA, concur in their respective organizations.

Part V examines a number of attempts—some experimental, others not—to apply more formal procedures in the selection of research activities and the allocation of resources to research. These include the Planning-Programming-Budgeting System (PPB) and its application in the Agricultural Research Service, the joint study of research needs by the Department of Agriculture and State experiment stations, the California Academic Responsive Budget System, Iowa State University's long-range planning effort, and the Minnesota Agricultural Research Resource Allocation Information System.

The book could be subtitled "The Limitations of Economics," for probably no other allocation problem pulls together so many of the challenging areas of practicing economics (or perhaps more completely, practicing social sciences). For example, issues raised include: What is the social welfare function in the United States? What is the production function for research? How do you measure the benefits of research, and performance? And on and on.

As a proceedings, the volume is unique since it is well integrated, with authors referencing and reacting to each other's ideas. Consequently, they perform superbly in addressing the issues and providing differing perspectives.

Unfortunately the book ends rather than concludes. The reader must generate his own conclusions. While this offers some merit, the benefits would have been much greater had one or two of the more perceptive symposium participants captured the essence for the reader. Fishel's conclusion to his discussion of the Minnesota effort offers at least one view:

> The proper role of quantitative techniques in the decision-making process of agricultural research administration has by no means been finally determined .... Undoubtedly, it will evolve only from a gradual chipping away at our rather formless rock of unknowns through many individual efforts like those reported here. Although the composition of this rock, as so frequently suggested, may well be granite rather than limestone, even granite will eventually take form under a patient hand. It seems to me that a more difficult problem may be convincing enough scientists and administrators that the number, magnitude, and complexity of the problems encountered are indeed penetrable and that the outcome is well worth their support.

But even this subjective judgment offers little direction.

In spite of this shortcoming the book represents an outstanding effort. Scientists would do well to read it lest they forget what they're about. Politicians could gain considerable insight into the challenging problems of research direction, as could the director himself. All three groups should be familiar with the issues.

Attention must continually be directed toward improving the allocation of resources to agricultural research, if for no other reason, because those who control funds will increasingly ask why funds are wanted. They will compare and weigh one request against others. They will ask what was accomplished, and ask for explicit reasons for choices and the consequences thereof.

David M. Bell

The Overproduction Trap in U.S. Agriculture

Edited by Glenn L. Johnson and C. Leroy Quance. Published for Resources for the Future, Inc., by the Johns Hopkins University Press, Baltimore, Md., 21218. 211 pages. 1972. $10.

The eight contributors to this book present a cohesive approach to the "farm problem" rather than a series of individual articles. Even though the farm problem has been the subject of a large number of books and articles, most readers interested in the farm problem will find this book worthwhile.

Since the book is designed to appeal to economists and noneconomists alike, much of part I will be repetitious for most economists. The authors placed most of the mathematical notation in the appendix, making easier reading for those not mathematically inclined.

Part I is a review of the characteristics of agriculture which result in expansion of production until product prices fail to cover investments and expenditures in producing farm products. The results are relatively abundant supplies of low-priced food for consumers and either low returns and capital losses for producers or taxes to shift the burden of losses from individual farmers to the public.

A good theoretical review is presented in part I, including extensions of the underlying causes of the farm problem. The review discusses low income elasticities for most foods and fibers, risk and uncertainty in agricultural production, the fixity of resources when acquisition costs greatly exceed salvage values, and the importance of decision-making with imperfect knowledge.

This largely historical work treats of the origin and efficiency of both private and public mechanisms for allocating resources in American agriculture. Part II is a set of chapters dealing with the allocation of land, labor, and capital, with each chapter by a different author or authors. The chapter on labor, especially, describes the effect of Federal programs on the allocation of labor. The chapter on capital discusses land-saving and labor-saving capital and the impact of changing capital structure.

The good and the bad of U.S. agricultural policies with brief recommendations for future restructuring of policy are discussed in part III. The unfavorable appears to overwhelm the favorable. Resources are being used to encourage farm production which is less needed than schools, hospitals, armament, and other nonfarm priorities. Price supports have increased farmers' price expectations, stimulating overinvestment in productive capacity.

The reader, however, will not find a panacea for the farm problem. The recommendations of improved knowledge, reduction of differences between acquisition and salvage values, and better control of entry of men and resources are not new. The statement in the summary, "A need is likely to continue for government to operate price-support and production-control programs despite our rather unfortunate experiences with these institutions to date," sums up the frustration that faces policymakers on the farm problem.

Allen Smith

The Advance of American Cooperative Enterprise: 1920-1945

By Joseph G. Knapp. The Interstate Printers and Publishers, Inc., Danville, Ill., 61832. 646 pages. $9.95.

Cooperative enterprise has been in existence as long as the country has, but the associations have received substantial recognition only in the last 50 years.

This book is the second volume of an intended three-volume history of the cooperative enterprise in the Nation. Volume I examined the development of cooperative associations into a distinctive form of business organization from 1620 to 1920. The proposed volume III will detail the activities of cooperatives during the social and economic growth since 1940. This book covers the years 1920 to 1945 and deals with what the author calls the "take-off" period. This period relates the progress of cooperative enterprise to important economic, social, and political changes. Indeed the year 1920 ended the period of establishment and was the start of the modern period of development. Cooperatives lost much of their business inferiority complex because they realized that they operate as a big business for their own benefit.

The author, Joseph Knapp, is well qualified to write on the subject. He was the first administrator of the USDA Farmer Cooperative Service and is respected among cooperative officials throughout the world.

Cooperatives burgeoned after World War I because they performed services needed by farmers at reasonable cost. Initially, during the early years following the war, there was an agricultural prosperity. However, the years that followed witnessed a depression for the agriculture economy while there was a general business recovery. Consequently there was a strong demand for monopolistic commodity marketing cooperatives which could control farm product prices. At that time, the American Farm Bureau Federation was formed and encouraged to promote cooperatives as a means of putting agriculture on a secure footing. The Federation forced the Government to recognize the value of self-help cooperative enterprises. By the time of the New Deal, the cooperative had evolved as a form of business organization and won support from the agricultural community. The New Deal agencies had a great influence on the cooperative enterprise. The Agriculture Adjustment Act and agencies such as the Farm Credit Administration, Tennessee Valley Authority, and Farm Security Administration supported and utilized the cooperative enterprise in their endeavor to organize agriculture on a sound business base.

This is an informative book for anyone interested in the cooperative enterprise in the United States. It would provide him with the first comprehensive historical treatment of the cooperative enterprise movement during its most important years.

Jack Ben-Rubin

Agriculture and the Common Market

By Stanley Andrews. The Iowa State University Press, Ames 50010. 183 pages. 1973. $7.95.

Quick recognition is given by the author to the abundance of materials already available on the

European Common Market. Although the unique contributions one can expect from this new volume are not clearly set forth, the importance the author places on agriculture in the European Community is indicated by such statements as these: "Agriculture is a special subject of concern because of its central role in the formation of the Common Market . . ."; "agriculture . . . made the Common Market functional . . ."; and "agriculture . . . saved the Common Market from dissolution."

This largely historical work treats of the origin and structure of the European Common Market, the place of agriculture as seen in the Rome Treaty, and the basic outline, operation, and funding of the common agricultural policy. Relationships between the Common Market and the United States, Great Britain, and the associated countries are discussed. Attention is also given to nontariff trade barriers, new trade legislation, and future U.S. trade policy.

Some of the discussion in the treatise is clearly peripheral to Common Market agriculture but is presumably added because the author believed it to be highly important and informative. Some examples, included as separate chapters in the 19-chapter discussion, are "The European Free Trade Association" (ch. 5), "The Grand Design" (ch. 7), "Agricultural Changes in Eastern Europe" (ch. 12), and "United States and Eastern European Trade Policies" (ch. 13).

The author believes that only a "genuine worldwide coordinated attack on production and distribution problems can prevent disaster to producers in the developed areas from overproduction and in some of the developing countries from starvation." As regards future agricultural trade, "negotiators will have to consider nontariff barriers to trade if they are to make additional progress." The author comments that "the United States has been operating under a do-nothing trade policy since June 30, 1967, when the Trade Expansion Act of 1962 expired," but points out that "world trade goes on" and that all this "probably adds up to the fact that the status quo, in trade as well as in business, is sometimes fairly satisfactory."

Writings by the author are buttressed by extensive travel in Europe. He has put together a quite readable book which includes the observations and viewpoints of numerous high-level people on both sides of the Atlantic.

One small clarification. The projections relating to U.K. membership in the Common Market (p. 51) and attributed to the Economic Research Service were in fact made by Oxford University under contract with ERS.

Reed E. Friend

Applied Research and Its Impact on Economic Development: The East African Case

By Michael Bohnet and Hans Reichelt. Weltforum Verlag, Munich, Germany. 210 pages. 1972.

This work consists of three distinct essays. The first is directed to general readers interested in development, the second to East African specialists, and the third to development economists.

Bohnet's first essay is an interesting nontechnical discussion of the various theories of economic development. It provides a review of the subject and might be worthwhile to give to our spouses if they are interested in an explanation of what we are trying to do. He also brings out some topics for possible research: "The development of synthetic coffee is only a matter of years" (a topic of greater interest to Brazil, Colombia, and the Ivory Coast, but one that should be considered in any case). But most readers of this journal can probably skip this section.

Bohnet presents a comprehensive study of applied research in Kenya and Tanzania. Anyone with a particular interest in research underway in East Africa would find this section almost indispensable. The more important agricultural commodities are handled separately and in a precise, intelligible way.

Reichelt combines a complete review of applied research underway in Uganda with a critical discussion of the value of applied research in underdeveloped countries. He makes a strong point that applied research must yield economic gains—and that it usually does not. As a solution, he suggests that applied research can only be profitable to a country when combined with the study of economics and, particularly for agricultural products, marketing economics.

It is a pleasure to read a book so well bound and carefully printed. There are a few translation and printing errors, but these are remarkably few and should not bother the reader.

John D. McAlpine

Land Resource Economics: The Economics of Real Property

By Raleigh Barlowe. Prentice-Hall, Inc., Englewood Cliffs, N.J., 07632. 616 pages. 1972. $13.95.

The new edition of a widely used text on land economics is welcome. The footnotes and suggested readings are updated, while some of the concern over better land use and conservation is discussed.

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